

so readily that the fluid should pass again into a solid centre. Another formidable difficulty is that a subterranean ocean must be subject to tides, as much as the sea would be though covered by ice. This is passed over somewhat lightly with the suggestion that viscosity may be sufficient to obscure all tidal phenomena. Doubtless, too, other difficulties will start up for which it may not be easy to find a solution. But every theory is sure to present difficulties. Time must show whether they multiply or die away.

One or two points do seem to emerge from this assemblage of calculations as fairly clear, and established on tolerably firm foundations. Such are, that contraction of the earth by cooling is inadequate to the production of its greater inequalities. The earth cannot be a mass quite so homogeneous as on the theory of having cooled from a perfect fluid it is often assumed to be. There must be subterranean irregularities of density. Besides these, the phenomena of volcanoes seems to be explained best, as yet, by the existence of vapours and gases in intimate mixture with the materials below its crust. And a substratum plastic, if not fluid, will account for many facts which are ordinarily very perplexing. But, to quote from a striking quotation made in the volume itself, "Of all known regions of the Universe the most unsafe to reason about is that which is beneath our feet." E. HILL

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Vignettes from Nature

ANXIOUS that popular scientific literature, especially that which deals with the Evolution-doctrine, should be strictly accurate in its facts, I would ask—in no unfriendly spirit—whether Mr. Grant Allen and Mr. Wallace have fully informed themselves upon each of the several positions taken in the paragraph cited with approval by Mr. Wallace (in the last number of NATURE, p. 381) from Mr. Grant Allen's "Vignettes," referring to the dimensions of the largest animals now existing, as compared with those of the faunæ of past epochs.

1. It is asserted that "no known extinct animal was as large as some of our modern Whales." When, some thirty years ago, I visited the so-called "coprolite" pits in the Suffolk crag, I was astonished at the multitude of the ivory-like "ear-bones" of whales found in a certain group of them; which were described by Prof. Owen, and compared with those of existing *Balenidæ*, in his "Fossil Mammals of Great Britain." From the fragments of gigantic ribs and vertebrae which I then saw at Felixstowe, I should certainly suppose the extinct whales they represent (which Prof. Owen regards as of Eocene age) to have been fully as large as those of the present time.

I would ask, further, whether sufficient account has been taken, in the statement just cited, of the most gigantic types of Reptilian Mesozoic life? Any one who has placed himself by the side of the huge bones of the *Cetiosaurus* which form such a conspicuous feature in the Oxford Museum, must, I think, be disposed to regard the animal there represented as having probably at least equalled the whale in bulk, though very likely not in length. And even this colossal reptile must have been far exceeded in dimensions by the *Atlantosaurus montanus* described by Prof. Marsh from the Wealden of Colorado. I would respectfully ask the authors, therefore, whether they are prepared to show that such an estimate is fallacious.

2. Having been led to believe, by all I have seen, heard, and read, that the ordinary bulk of our existing Elephants (I do not

speak of exceptional "Jumbos") was considerably exceeded by that of the Mammoth and Mastodon—the former surpassing them in height (see the comparative measurements given by Prof. Owen, *op. cit.*), and the latter in length of body, I cannot but feel surprised that Mr. Grant Allen should speak of elephants "as having been increasing in size from the earliest epoch of their appearance to the present day"; still more, that Mr. Wallace should endorse the statement. Of course I shall at once bow to the superior knowledge of the latter most distinguished zoologist, when he refers me to trustworthy measurements in support of his position.

3. I can speak with more confidence in regard to the relative size of extinct Sharks, none of which, in the judgment of Mr. Grant Allen and Mr. Wallace, surpassed the forty-foot sharks of the present time. For I have now before me a tooth of a fossil shark (found in one of the before-mentioned "coprolite pits") of pretty regular triangular form, measuring four inches in length, three inches across the base, and seven-eighths of an inch in thickness between its flat surface and the most protuberant part of its convex surface; and I have seen others much larger, the length of some being said to range to six inches. Now when I brought this tooth home, I took an early opportunity of comparing it with the largest teeth of existing sharks that I could find in the British and Hunterian Museums, and found these to be pigmies by comparison. Unless, therefore, I can be referred to some fresh source of information, I must continue to believe (*pace* Mr. Grant Allen and Mr. Wallace) that some of the older sharks were far larger than any of which we have any knowledge at present.

4. Is it clear that *Tridacna* is the largest known Mollusk? I should have thought it exceeded by the gigantic *Ammonitida*, the largest specimens of which are not always to be found in museums; for I have seen one at Redcar (whose diameter I am afraid to state from memory, for fear of exaggeration) so massive that no one had undertaken the task of removing it.

5. No mention is made of *Crustacea*, though I should have thought that important class worthy of notice. I would ask where any existing crustacean types are to be found, that surpass in size the gigantic *Eurypteride* or even the largest *Trilobites*.

6. Of the *Foraminifera*, one of the most important classes in the whole animal kingdom for the share it has taken in the formation of our limestone rocks, I venture to speak with some special knowledge. The largest examples of this group known to us at the present time are the *Orytholites* and *Cyclolypus*. The former is a very widely diffused type, but only under peculiar local circumstances exceeds an inch in diameter, or one-tenth of an inch in thickness; the latter is (so far as I am yet aware) restricted to one locality, and, though attaining the large diameter of 2½ inches, is scarcely thicker than an ordinary card. If these be compared with the massive *Nummulites* and *Orytholites*, of which the vast *Nummulitic* limestones are composed, the advantage will be found clearly on the side of the latter.

But, in conclusion, I think it will be conceded that in estimating the general dimensions of a Fauna, we must take into account not merely the size of its largest animals, but the range of their distribution; and I would ask Mr. Wallace (whose knowledge of this subject no one appreciates more fully than myself) whether this consideration has been duly weighed by him. Our existing colossal land mammals (elephants, giraffes, rhinoceroses, and hippopotamuses) are limited to the tropical and sub-tropical regions of the Old World; while the great American continent is entirely destitute of them. Let this state of things be compared with the former extension of the Mastodon¹ and Mammoth through North America (which had for its own also the gigantic *Bronthotheride*), as well as over Europe and Northern Asia; and the nearly equal range of the Rhinoceros and Hippopotamus (some species of all which seem to have lived contemporaneously during the Quaternary Period); whilst at the same time the wide area of South America was tenanted by another Mastodon, as well as by the colossal Sloths. There can be no reason to suppose again that the great *Balenidæ* were less abundant during the later Tertiary and Quaternary epochs, than they were either previously or subsequently. And if the evidence of the abundance of some of the colossal land-Mammals—afforded by the vast accumulation

¹ That the Mastodon, though it appeared much earlier than the Mammoth in the Old World, continued to exist in the New during the Quaternary period, is now, I believe, generally admitted. I myself, at the request of Dr. Warren, examined the contents of the well-preserved specimen obtained by him, and found therein twigs quite fresh enough for the microscopic recognition of their Coniferous structure; and Prof. Asa Gray told me last summer that he could clearly identify them with a well-known existing type.

of Mammoth-tusks in the frozen mud of Siberia, and by the wonderful aggregation of Hippopotamus-bones revealed to us by Dr. Falconer's explorations in the Palermo caves—be also taken into account, we can scarcely, as it seems to me, avoid the conclusion, that the period in the later stages of which we get the first indubitable evidence of Man's existence (to say nothing of any anterior to it) was much more distinguished than the present for the aggregate bulk and wide distribution of the largest members of its fauna.

WILLIAM B. CARPENTER

CAN Mr. Wallace throw any light on Mr. Allen's somewhat extraordinary sentence: "I feel a genuine respect for every donkey I meet, *when I remember that it was the mere accidental possession of an opposable thumb* that gave my ancestors a start over his in the race for the inheritance of the earth towards the very close of the tertiary period." I take Mr. Allen to be an evolutionist, but there is no place for accident in evolution, or in any other scientific theory. The "opposable thumb" must be the result of some conditioning factor, and this being so the word accident is quite out of place.

¶¶

February 27

Moths Attracted by Falling Water

WHILST watching the great horse-shoe falls of the Skjál-fandafljót near Ljósavatn in Iceland, I saw moth after moth fly deliberately into the falling water and disappear. Some which I noticed arriving from a distance, fluttered at first deviously, but as they neared the water flew straight in. The gleaming falls seemed at least as attractive as artificial light, and if the fact has not been observed in this country I should suppose it is because the moths likely to be attracted, fly by night, whilst in Northern Iceland there is no night during the summer. The preference trout show for pools near falls is more likely to arise from the extra food they find there, than the more aerated state of the water. The latter supposition, seeing the number of species of lake trout, always seemed to me a lame one, invented for want of a better, whilst the former explains why broken water is always inhabited by insectivorous fishes. The instinct of self-destruction in moths must be older than the introduction of artificial light, and cannot be of use exclusively to collectors, but though its benefits to salmon and trout are obvious enough, its advantages to the moths are not so apparent, unless this self-devotion checks an increase that otherwise would be disadvantageous.

J. STARKIE GARDNER

Hypothetical High Tides

I HAVE no desire to constitute myself a champion of Mr. Ball's high tides, but I do not think that the testimony of the Coal-Measures, to which Mr. S. V. Wood calls attention, will decide much. These deposits are mainly of non-marine origin, the plants being terrestrial, and the prevailing mollusc, *Anthracostris*, closely resembling *Unio*. Marine strata do indeed occur, but in almost inappreciable proportion. If it be objected that, in these marine episodes, the hypothetical tidal wave must have wrought fearful havoc; I would suggest that there is no proof that in the Carboniferous epoch the speed of the wave was enormously greater than at present. When we reflect that by that time nearly, if not quite all the classes of the animal kingdom had come into existence; we can hardly avoid the conclusion that the Coal-Measures were formed in a period which, in comparison with the age of the globe, must be regarded as comparatively recent. Considering how slight is the denuding power of modern tides, I doubt if even a treble velocity would materially increase the effect.

Mr. Eldsen's suggestion that the accelerated tidal wave may account for the absence of estuarine deposits before the Carboniferous epoch, takes for granted what remains to be proved. How do we know that there were no pre-Carboniferous deltas? We recognise estuarine strata by the intermixture of terrestrial or fresh-water fossils with marine organisms. The Old Red Sandstone of Britain, being a lacustrine deposit, does not bear upon the question; but I see no reason why the Devonian strata of Russia, in which, according to Murchison, fresh-water fishes are associated with marine shells, may not be in part of estuarine origin. Below the Devonian, the evidence of terrestrial life is very meagre; and to infer from its absence in a set of beds that they must be marine, would be hazardous reasoning.

I do not make these observations in the interests of any theory, but simply to evoke discussion on a very interesting question.

Wellington, Salop, March 3

C. CALLAWAY

Rime Cloud observed in a Balloon

I SEE in NATURE, vol. xxv. p. 385, an interesting letter from a German physicist, who comments on the recital of my last balloon ascent (January 25, 1882) as published in your columns. I am very grateful for the numerous instances of *frost-rime* that he quotes as having been observed on former occasions, but I cannot possibly admit his theory of the liquidity of minute water-drops suspended in the air at a low temperature. The reason why I object to this view was explained more than a century ago by the celebrated Bouguer, when describing in 1744, to the French Academy of Sciences the corona he observed in the Andes on the occasion of his ascending the Pichincha. I beg leave to quote this interesting account of a quite forgotten exploration:—

"On voit presque tous les jours sur le sommet de ces montagnes un phénomène extraordinaire qui doit être aussi ancien que le monde, et dont il y a bien de l'apparence que personne n'est été témoin avant nous. Chacun de nous vit son ombre projetée sur un nuage qui n'était point à trente pas. Le peu de distance permettant de distinguer toutes les parties de l'ombre—on voyait le bras, les jambes, la tête; mais ce que nous étonne c'est que cette dernière partie était ornée d'une gloire ou d'une aureole formée de trois ou quatre petites couronnes concentriques d'une couleur très vive, chacune avec le mieux nuance que l'arc-en-ciel primaire, c'est à dire le rouge en dehors.

After having insisted on the description of the phenomenon (*Mémoires de l'Académie* pour 1744, p. 264 and 265), Bouguer says:—"Le phénomène ne se trace que sur les nuages formés de gouttes de vapeur et même sur ceux dont les portraits sont glacées, mais non sur les gouttes de pluie comme l'arc-en-ciel." Having seen the *corona* for more than an hour, almost without interruption, and nothing resembling a rainbow, I cannot possibly admit any liquid water in the cloud, and I am obliged to oppose the surfusion theory as advocated by M. Jamin, to explain the crushing by ice-crystals of the loftiest trees of the Forest de Fontainebleau.

W. DE FONVIELLE

Paris, February 26

The Markings on Jupiter

MR. DENNING's interesting communications in NATURE (vol. xxv. pp. 223, 265) led me to consult my notes of observations of Jupiter made in the summer of 1878. I used a telescope of only $3\frac{3}{8}$ inches aperture, but of exquisite definition, made by John Byrne, of New York. Under date of July 7, 1878, I find this entry:—"10 p.m.—There is a remarkable light spot near the centre of the light equatorial zone of Jupiter."

On July 27 I wrote:—"I saw on the bright equatorial belt of Jupiter a spot of obviously greater brightness than any other part of the disk. Just above and to the west of it was a dark spot on the southern belt. The bright spot grew more distinct as it approached the centre, and caught the eye the instant it was placed at the eyepiece. The bright spot was equal in diameter to about two-thirds of the width of the south belt."

Again on July 31:—"Saw a white spot on the light equatorial belt, probably the same seen on the 27th."

I have also sketches of Jupiter made in the fall of 1879, from which I see that on September 4, at 10 p.m., there was a distinct white spot indenting the northern border of the great south belt, and opposite the forward end of the red spot. On September 6 this white spot had advanced, so that it was ahead of the red spot. Other fainter white spots are shown in my sketches. These rude observations may be of some use in assisting Mr. Denning to trace back the history of the remarkable markings that for three or four years have attracted so much attention to Jupiter.

G. P. SERVISS

New York, February 9

The Level of the Mediterranean

AMONG the "Notes" in NATURE, vol. xxv. p. 395, I read Prof. Naudin's opinion on the apparent lowering of the level of the Mediterranean along the whole Riviera during the months of January and February; but I think there is a far more simple explanation of the phenomenon. In Genoa we had for many days as much as 43 centimetres below the standard level, but that was